

# **Pushing the Energy Efficiency Envelope through Appliance Standards Around the World**

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Executive Director, CLASP*

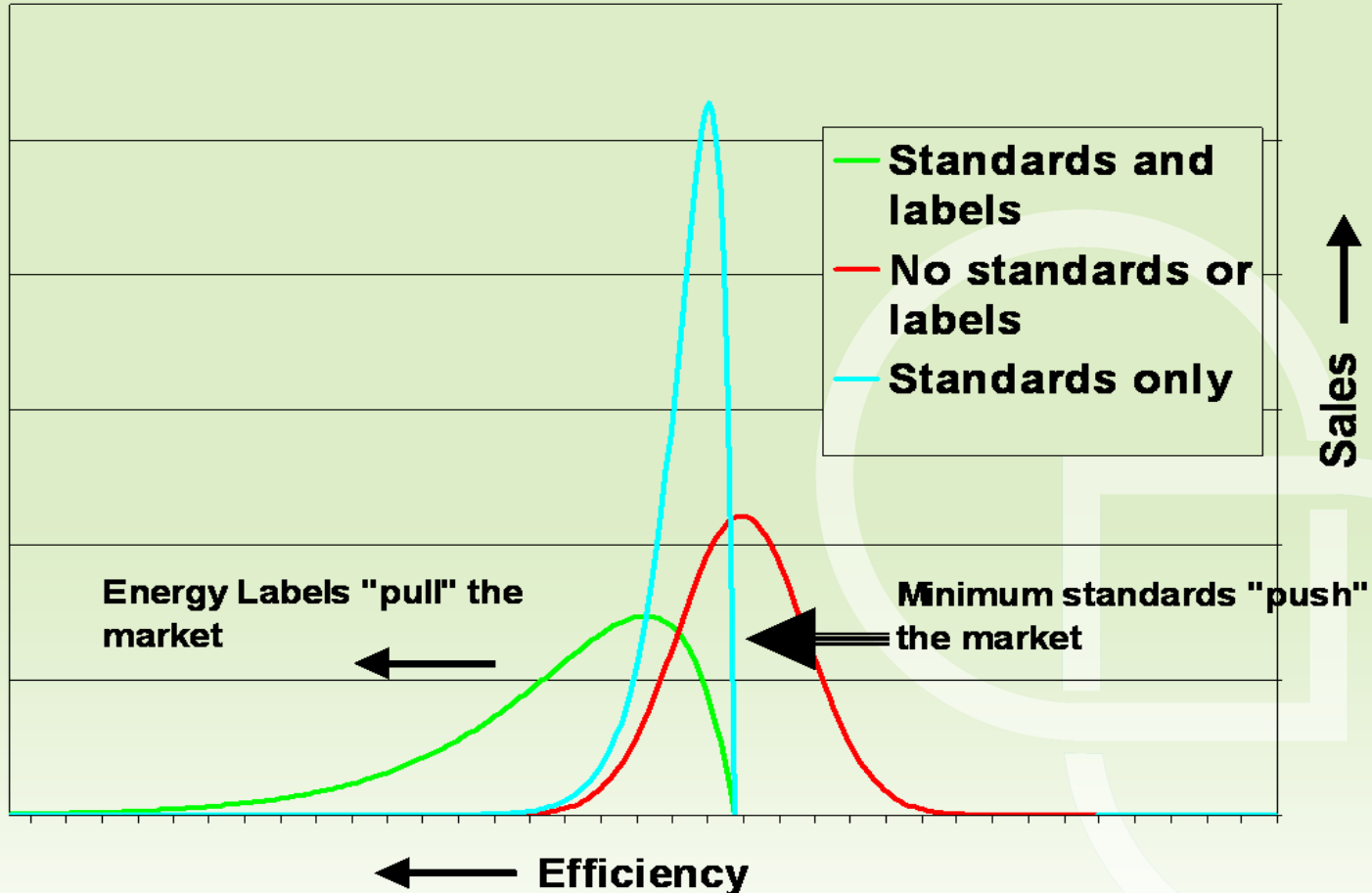


# Over 75 countries with more than 80 percent of the world's population have energy standards & labeling

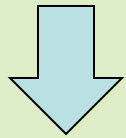


# Market Transformation

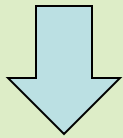
Standards and labels work together to push and pull the market toward greater energy efficiency.



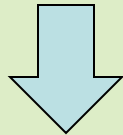
# Standards and Labeling Programs Impact the Environment



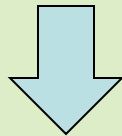
Reducing the energy consumption of a product



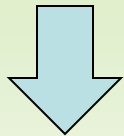
On aggregate, reduces overall energy consumption



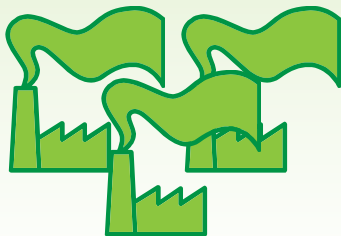
Which, reduces power demand



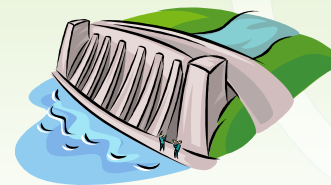
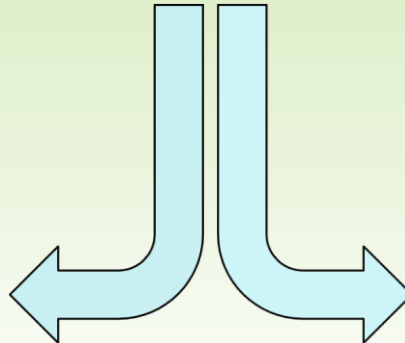
Which, reduces the need for the production of electricity



Therefore, reducing green house gas emissions and other pollutants



And, increasing the feasibility of renewable



# Reasons for Implementing Standards and Labeling Programs

Countries adopt standards and labeling policies for a number of reasons

1. Reduce capital investment in the energy supply infrastructure
  - a) Less expensive than energy production
  - b) Makes renewable energy more affordable by reducing the need for energy production
2. Avert urban/regional pollution
3. Promote competitiveness of domestic manufacturers by avoiding non-tariff trade barriers
4. Secure energy independence
5. Meet climate change goals

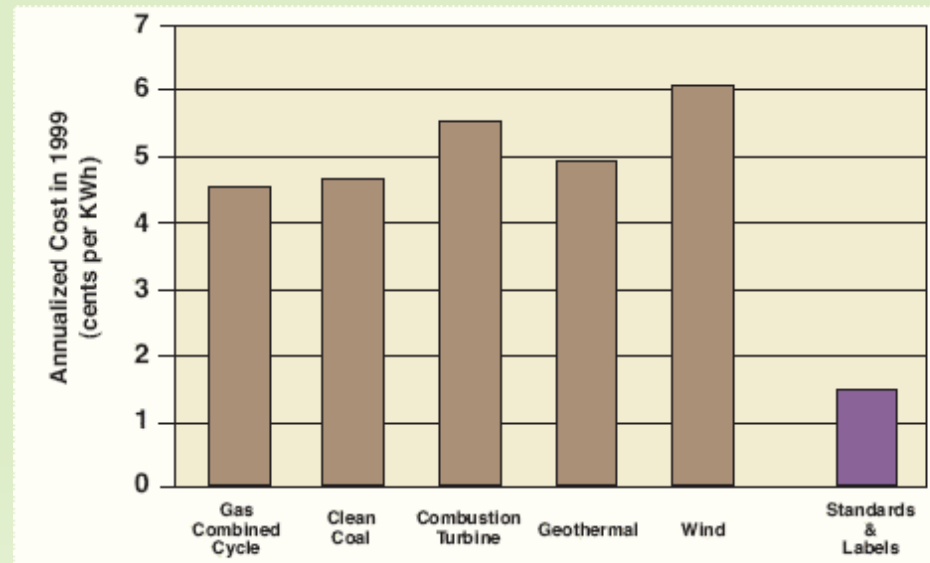


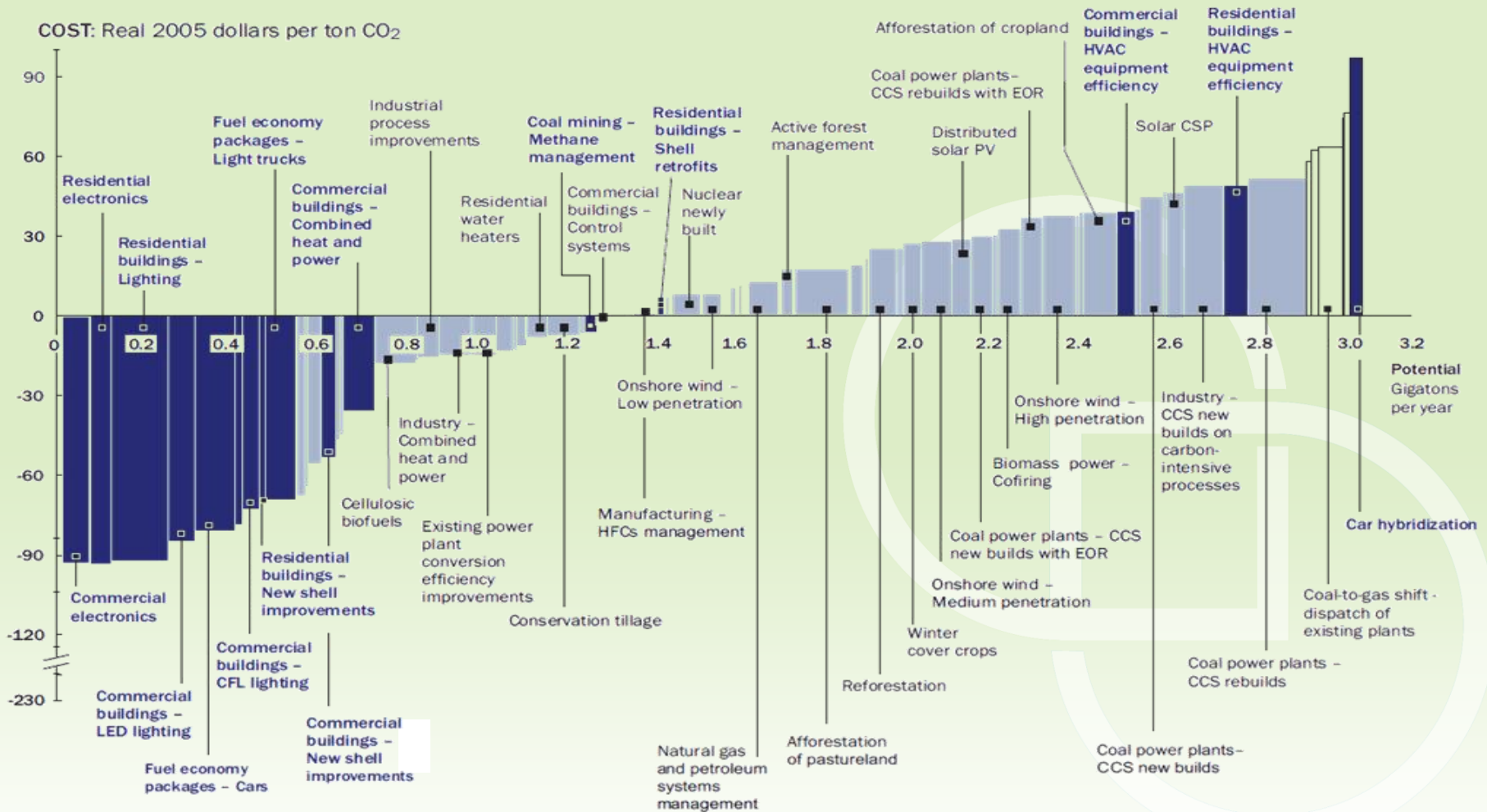
Figure 2-2 The cost of electricity in the U.S. from various new sources  
 Source: U.S. Energy Information Administration's National Energy Modeling System and (Meyers 2004)

# Buildings Technology Efficiency is Most Cost Effective

## U.S. mid-range abatement curve - 2030

Carbon dioxide abatement: estimated removal cost per ton of CO<sub>2</sub> in 2005 dollars and removal potential in gigatons/yr for various strategies.

Abatement costs <\$50 per ton



# Energy Efficiency Standards

Energy efficiency standards “**PUSH**” the market towards greater energy efficiency by removing inefficient products from the market.

- **Prescriptive Standards** require that a particular feature or device be installed in all new products.
- **Minimum Energy Performance Standards (MEPS)** require that a manufacturer achieve in each and every product a minimum efficiency (or maximum energy consumption); but does not require a specific technology or design.
- **Class-average Standards** specifies the average efficiency of a manufactured product, allowing each manufacturer to select the level of efficiency for each model so that the overall average is achieved.



# Energy Efficiency Standards (Minimum Energy Performance Standards)

1. The government sets a limit on the total amount of energy a product can use annually

$\leq 400 \text{ kWh/a}$

2. The manufacturer designs the product to use less energy than the limit
3. The manufacturer tests the product using a designated test procedure to certify it uses less energy than the limit
4. The manufacturer then submits these results to the government or self-certifies them
5. The product can be sold on the market

Martes 24 de abril de 2001 DIARIO OFICIAL (Primera Sección) 1

**SECRETARIA DE ENERGIA**

NORMA Oficial Mexicana NOM-021-ENER/SCFI/ECOL-2000,  
Eficiencia energética, requisitos de seguridad al usuario y  
eliminación de clorofluorocarbonos (CFC's) en acondicionadores  
de aire tipo cuarto. Límites, métodos de prueba y etiquetado.

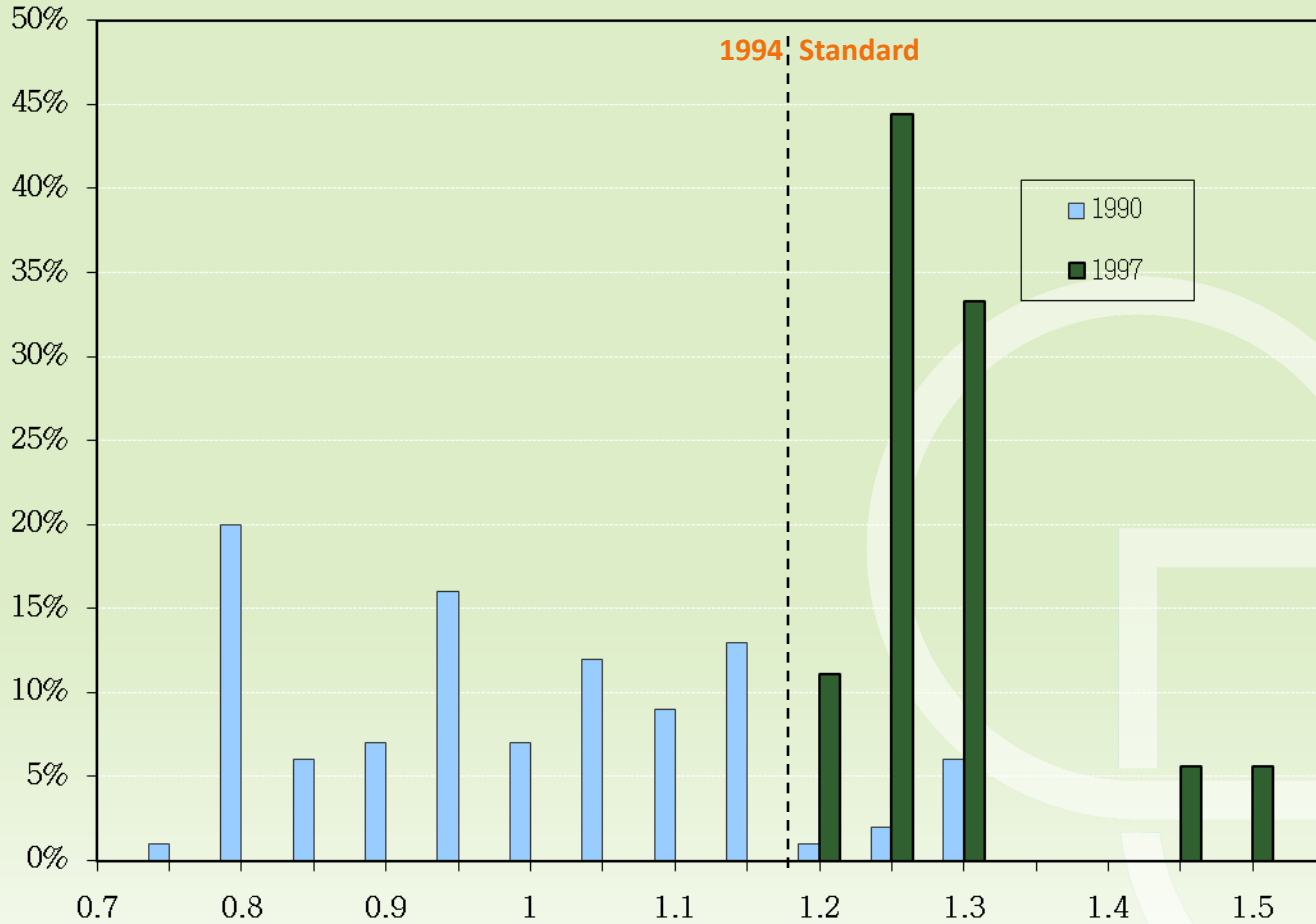
TABLA 1.- Valores de la Relación de Eficiencia Energética

Clase	REE
1	2,84
2	2,84
3	2,87
4	2,84
5	2,49
6	2,64
7	2,64
8	2,49
9	2,49
10	2,49

Source: CONUEE

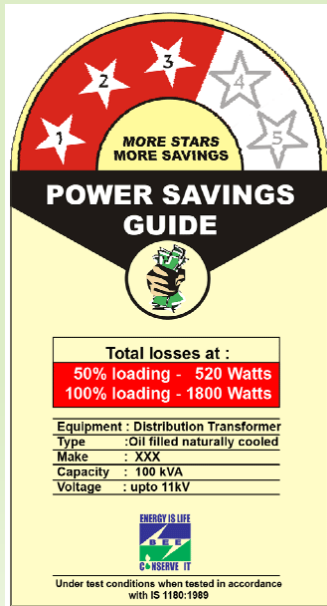


**Clothes Washer Energy Factors in the U.S. before and after the 1994 standard**

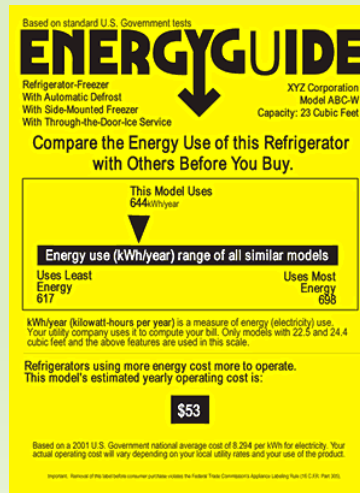


# Comparative Label

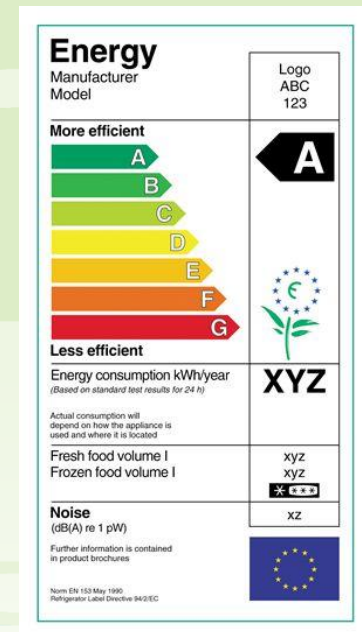
Comparative energy efficiency labeling “**PULLS**” the market towards greater energy efficiency by allowing consumers to compare the energy efficiency of products while making a purchasing decision, thus motivating manufacturers to build products that are more efficient than their competitors.



Categorical Label (Dial)



Continuous Label



Categorical Label (Bars)

# Comparative Labels (Categorical)

1. The government sets discreet categories based on specific ranges of energy use allowing comparison between products

Category	Energy Range
A	<400 kWh/a
B	400 – 499 kWh/a

2. The manufacture builds the product and test its energy use using a designated testing procedure in order to determine the proper category
3. The manufacture submits the results to the government or self certifies
4. The manufacturer labels their product with the correct category

# Endorsement Label

Endorsement energy efficiency labeling “PULLS” the market toward greater energy efficiency by identifying for consumers the most energy efficient products, thus providing an incentive (market advantage) for manufacturers to build highly efficient product.



United States



European Union



Korea

# Endorsement Labels

1. The government sets a minimum energy use threshold for entry into a program which recognizes highly energy efficient products

$$\leq 100 \text{ kWh/a}$$

2. The manufacturer designs the product to use less energy than the threshold so the product can receive this recognition
3. The manufacturer tests the product using a designated test procedure to certify it uses less energy than the threshold
4. The manufacturer then submits these results to the government that reviews and approves it
5. Once it has been approved, the product's packaging can be labeled with the endorsement label, the manufacture can advertise the product's endorsement, and usually the product will be listed on a government website

## Advantages of MEPS

- Provides predictable effects of eliminating low-efficiency products
- Easy to ratchet levels periodically
- Can be designed to maximize consumer benefits
- Very low per unit transaction costs
- Technology costs borne by consumer who also receives savings benefit

## Disadvantages of MEPS

- Usually a mandatory program – requires consensus/cooperation among multiple stakeholders
- Can incur some up-front costs for consumers
- Requires good enforcement policy

## Savings Potential

- Determined by available technology and cost-effectiveness

## Major Stakeholders

- Manufacturers, environmental groups, consumer groups

# Comparative Labels

## Advantages of Comparative Labels

- Efficiency less compulsory - gives manufacturers the option of a wide range of efficiencies
- Provides strong market incentive for efficiency
- Market evolves over time at accelerated pace
- Low per unit transaction costs
- Technology costs borne by consumer who also receives savings benefit

## Disadvantages of Comparative Labels

- Impact of program less predictable
- May be difficult to change labeling scheme
- May or may not maximize consumer benefits

## Savings Potential

- Determined by market demand for higher efficiency products

## Major Stakeholders

- Manufacturers, environmental groups, consumer groups

## Advantages of Endorsement Labels

- Usually voluntary - manufacturers can opt in or out
- Provides market association between efficiency and quality
- Can have large impact if endorsement level becomes de facto standard
- Low per unit transaction costs
- Technology costs borne by consumer who also receives savings benefit

## Disadvantages of Comparative Labels

- Impact of program difficult to predict
- May or may not maximize consumer benefits

## Savings Potential

- Determined by market demand for highest efficiency products

## Major Stakeholders

- Manufacturers, environmental groups, consumer groups



# Test Procedure

Test procedures are the foundation of any standards and labeling program as they are used to determine the energy use of a product.

Test procedures should:

- Reflect typical usage
- Yield repeatable and accurate results
- Be relatively inexpensive to perform

Test procedures can be developed either in country or adopted from an international body.

Testing should be conducted in an accredited laboratory to ensure that tests are being conducted properly.



Chinese Air Conditioner Testing Facility

# Manufacturing Cost vs. Energy Savings

Product energy efficiency is the result of a series of incremental modifications to features, technology, and design.

The goal of standards and labeling setting is to strike a balance between increased costs of manufacturing and energy savings.

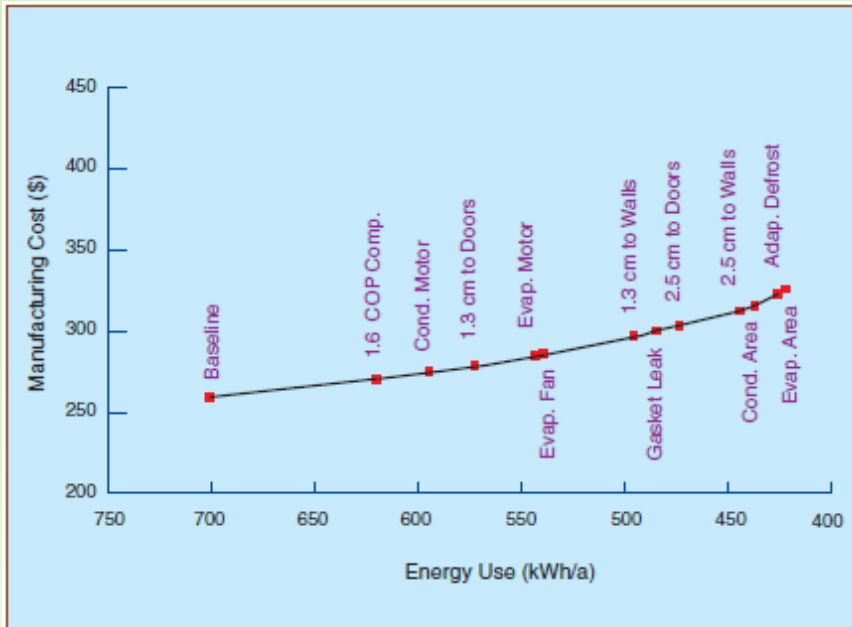


Figure 6-5 Example of fundamental data for engineering analysis: U.S. top-mount auto-defrost refrigerator-freezer

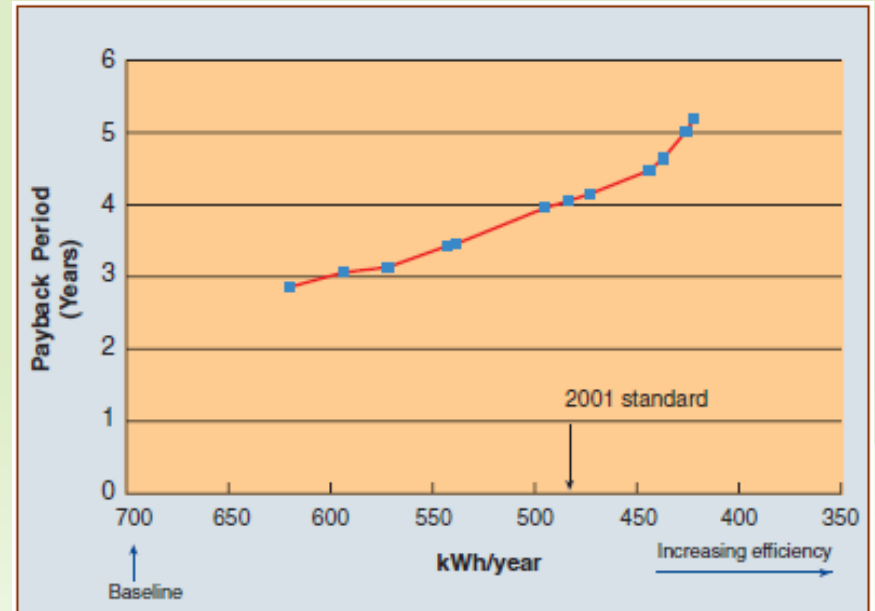
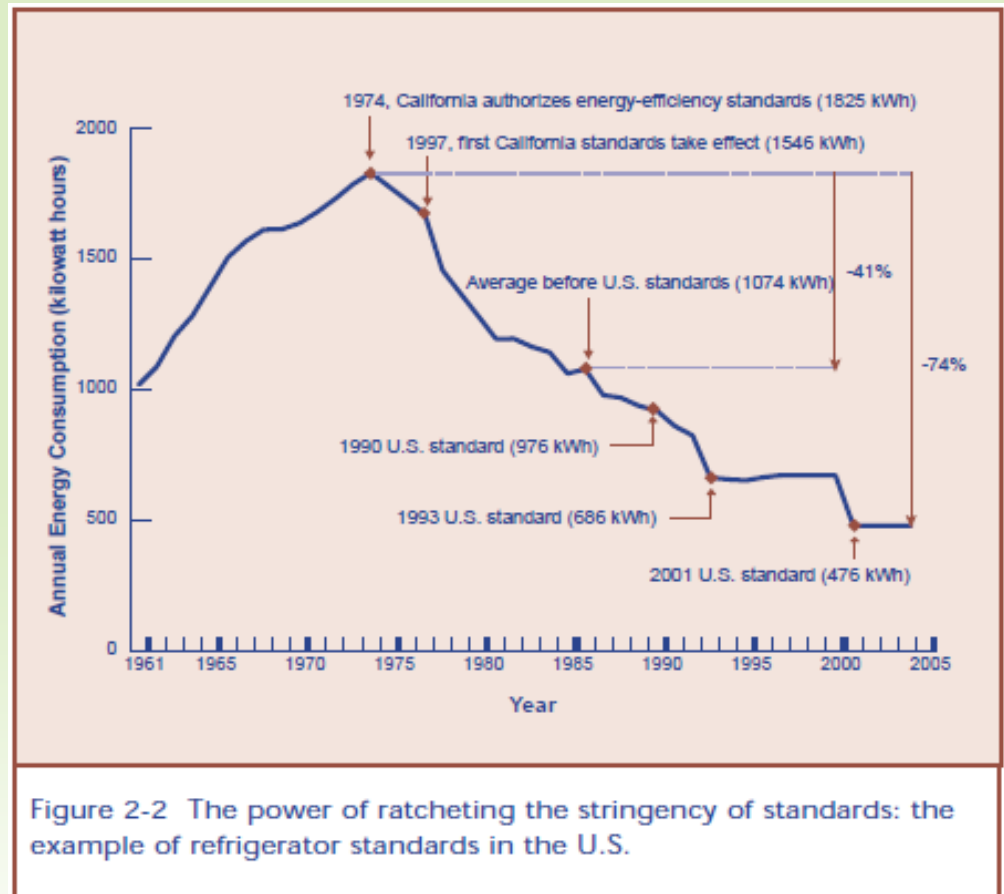


Figure 6-7 Payback periods for top-mount automatic-defrost refrigerator-freezers.

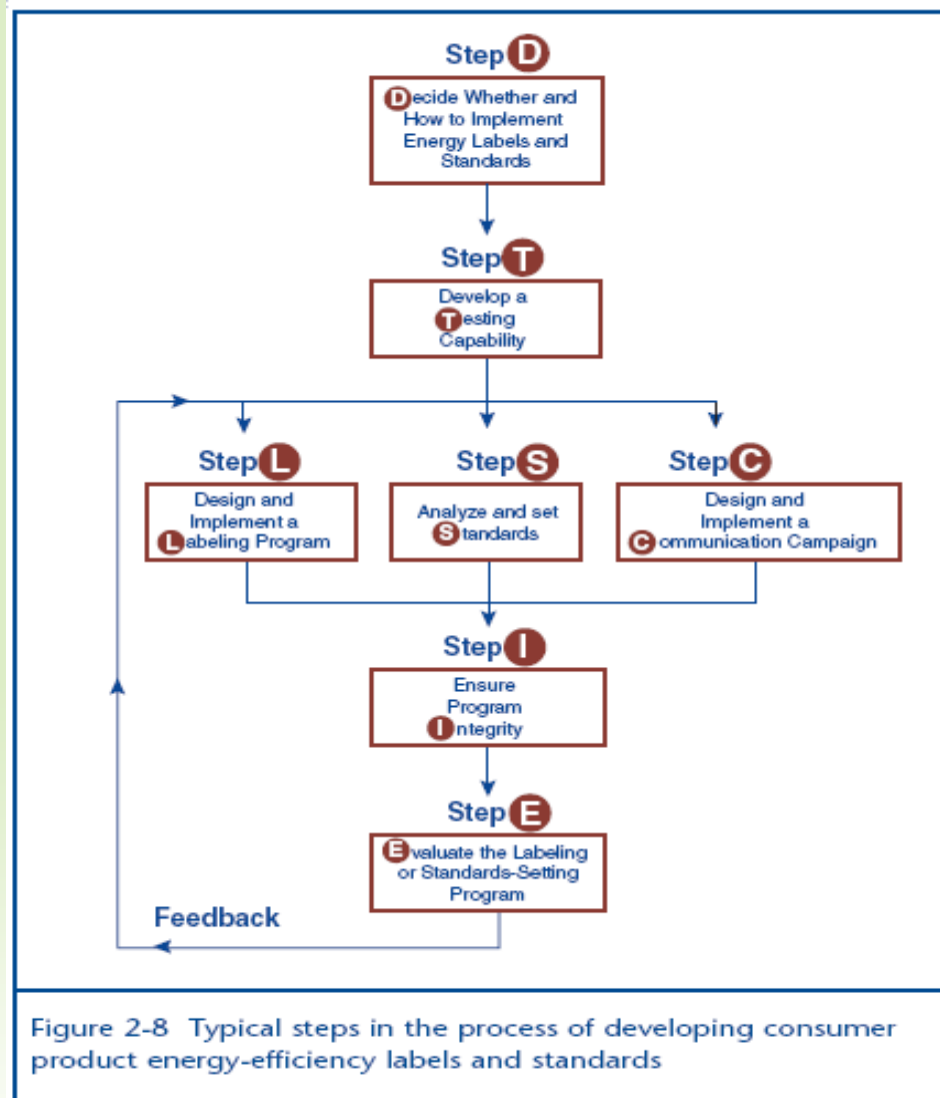
# Updating Standards and Labels

Standards and labels must be continually reviewed and revised (3-5 years) to increase stringency and drive continued energy savings.

- As new energy saving technologies are developed and become more cost effective it is important to continually update the stringency of standards.
- Once the market has become oversaturated with high energy efficient products it is necessary to increase the stringency of label requirements in order to keep labels meaningful to consumers.



# Seven Steps in S&L Development



# S&L Programs Require Resources

## Legal and Authoritative Resources

- Clear mandates and lines of responsibility from framework legislation and/or implementing regulation

## Financial

- A regular and consistent source of operational budgets; annual allocations? Fees from testing and/or labeling?

## Human Resources

- Qualified staff to manage implementation as well as conduct market analysis; some outsourcing possible but base management requires dedicated staff


## Physical/Facilities

- Central offices, field facilities for monitoring/enforcement and/or laboratories for testing?

## Institutional

- All of the above should culminate in a managing institution with program responsibility

# **Standards and Labeling: Common Challenging Aspects**



# Common Challenges in the Test Lab and Testing Arena

- Finding the financial resources for a bricks and mortar (versus policy) project
- Getting the order right—need the test lab and procedure before you can regulate
- Defining the Business Model
  - Limited amount of mandatory testing to support business model
  - How to leverage private R&D testing to support the business model
- Test Standards and Test Methods
  - Lack details required to perform tests in the same way across multiple laboratories
  - Do not address innovation and emerging technologies
  - Test Procedure development not synced well in advance of regulations
  - Test Procedures “Slow to Change”
  - Allow “Gaming” during the test process that influence results
  - Correlation between laboratories
  - Uncertainty and Repeatability of test results
  - Difference in Field Data Results vs. Lab Data Results
  - Cost of testing

## ANALYSIS 1: Based on GHG Abatement Potential in India

GHG abatement Potential

=

Surviving stock

X

Annual energy consumption

X

Energy saving potential of the appliance

X

Electricity/fuel emission factor

- The model compares GHG Abatement Possible in year 2030 due to application of S&L to the considered products
- The products sold on or after 2014 and surviving till year 2030 have been considered
  - Normal distribution considered for products' useful life
- Calculated based on Hourly Energy Consumption (daily hours of use) days of use per year
- Decided based on maximum theoretical improvement possible, depending upon present performance and specific areas of improvement *e.g. in stand by and operating condition*
- To facilitate comparison for different fuel types, emission factors have been used to quantify environmental impact on basis of tonnes equivalent of CO<sub>2</sub> abated



# Multiple Scenarios Can Be Analyzed

## ANALYSIS 2: Based on GHG Abatement Potential and Market Implementability - Both in India

### Need

- The product may have high overall GHG abatement potential but the actual implementation of effective labeling program may be difficult due to a host of market and management factors
  - Therefore, we need to include these as well to ensure a more realistic analysis

### Basis

- A normalized score for GHG abatement potential is calculated.
- We also calculate the score for 'market implementability' (market implementability index)
- A weighted score for both the parameters gives the ranking for products

### Calculation of Market Implementability index

- Market Implementability index is calculated based on following parameters:
  - Test Procedures / Standards
  - Number of stakeholders (manufacturers)
  - % organized sector
  - Implementing association/ partner

The Products are given a score on a scale of 0-4 (0=worst, 4= best) for all these parameters and final scores calculated based on parameter weight and score

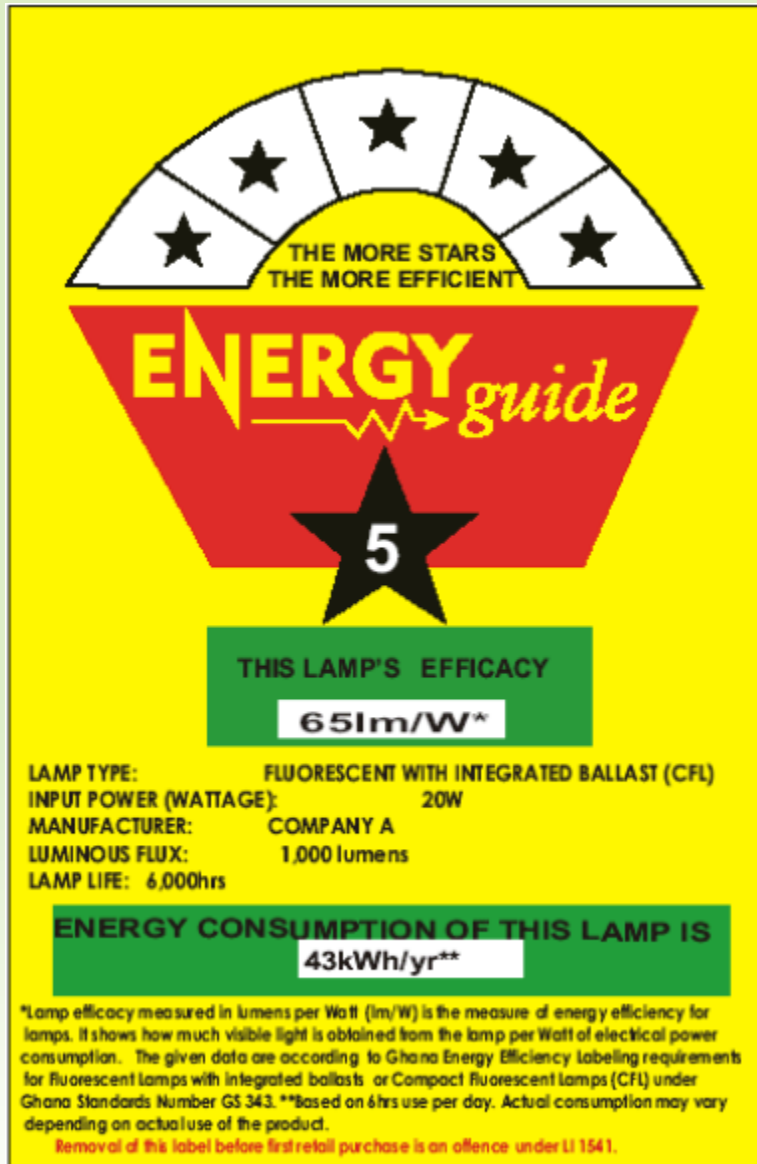
## Overall Ranking Based on GHG Abatement and Market Implementability - Only Appliances

Rank	Product	Main Category	GHG Abatement Potential	Market Implementability Score
		<i>present analysis criterion weight =</i>	<b><u>75%</u></b>	<b><u>25%</u></b>
1	Air Conditioners	Home Appliances & Equipments	92.8	1.0
2	CTVs	Consumer Electronics & External Power Supply Equipment	51.1	1.0
3	Ceiling fans	Home Appliances & Equipments	26.9	0.9
4	Refrigerators	Home Appliances & Equipments	15.3	1.0
5	Washing Machines	Home Appliances & Equipments	2.3	1.0
6	Set top boxes	Consumer Electronics & External Power Supply Equipment	9.5	0.8
7	Uninterruptable Power Supply	Consumer Electronics & External Power Supply Equipment	13.1	0.7
8	Geysers	Home Appliances & Equipments	3.0	0.9
9	Table Fans/Pedestal/Wall Mounted	Home Appliances & Equipments	5.6	0.7
10	Microwave Ovens	Home Appliances & Equipments	0.8	0.8

## Ranking based only on GHG Abatement potential – only appliances

Rank	Product	GHG Abatement Potential (mt CO <sub>2</sub> )	Energy Savings (MWh)	Main Category
1	Air Conditioners	92.8	113,150,099	Home Appliances & Equipments
2	CTVs	51.1	62,318,944	Consumer Electronics & External Power Supply Equipment
3	Ceiling fans	26.9	32,750,833	Home Appliances & Equipments
4	Refrigerators	15.3	18,631,278	Home Appliances & Equipments
5	Uninterruptable Power Supply	13.1	16,010,105	Consumer Electronics & External Power Supply Equipment
6	Desert Coolers	11.1	13,482,559	Home Appliances & Equipments
7	Set top boxes	9.5	11,538,966	Consumer Electronics & External Power Supply Equipment
8	Table Fans/Pedestal/Wall Mounted	5.6	6,877,630	Home Appliances & Equipments
9	Exhaust Fans (ventilation fans)	3.4	4,135,441	Home Appliances & Equipments
10	Geysers	3.0	3,657,545	Home Appliances & Equipments

# Good Label Design Requires Market Research with Stakeholders—Particularly Consumers



- Even though the Ghana program was one of our smallest (~\$110,00 per year) CLASP provided T.A. for market research for Ghana label design
- Small sample of consumer focus groups
- Categorical design based on stars was most influential
- Colors and star design reminiscent of Ghana flag to identify labeling as a national program



## All S&L programs have rules

- Mandatory and voluntary programs
- Contained in legislation or administrative guidelines
- Compliance means adherence to these sets of rules
- Obligations may apply to different stakeholders: suppliers, importers, retailers, wholesalers, on-line suppliers, etc

## Rules adopted by different programs vary according to many factors

- Existing legislation, political ambition, national governance issues, resources (in-house and external), stakeholder attitudes, etc.

**But all programs have processes and systems to check compliance – the “*compliance regime*”**

**This regime (should) comprise several distinct but interrelated elements**

# Key Elements

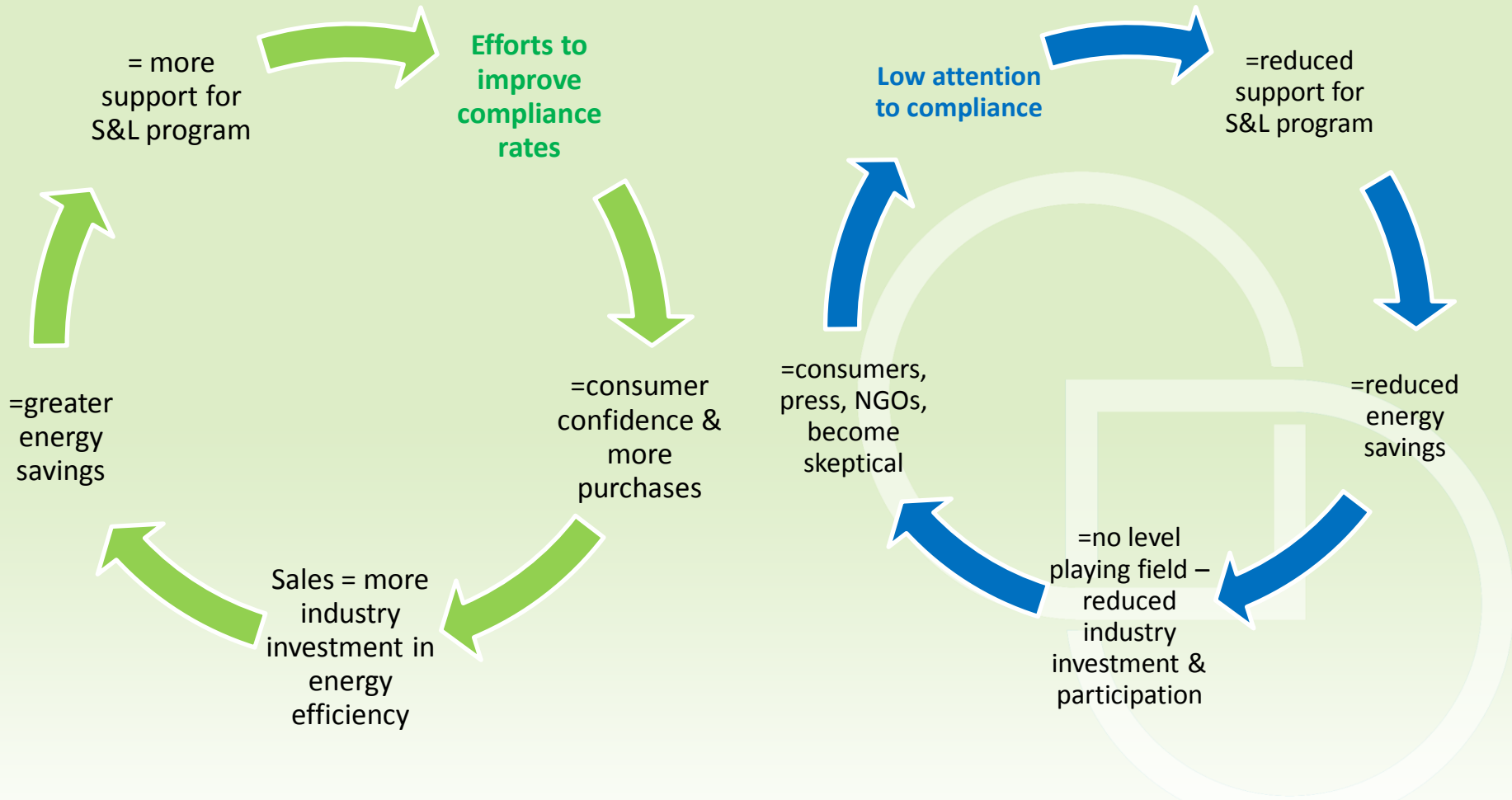
- Designing for, and facilitating, compliance
  - Market surveillance (monitoring)
  - Verification testing
  - Enforcement
  - Communication
  - Legal and administrative framework
  - Budget
  - Evaluation
- ✓ **All elements have to be included for the system to work and the required outcomes achieved.**



# Why Worry About Compliance?

- Safeguard the investment made by governments in building up the credibility of their voluntary and mandatory energy labels;
- Risk that failure to address non-compliance can lead to serious long-term consequences through the erosion of consumer confidence;
- Will require a considerable effort to re-establish credibility;
- Consumers pay for performance that they do not receive;
- Safeguard the investment made by compliant industry participants in order to manufacture and supply energy efficient products;
- Without adequate enforcement, the compliant industry participant is penalised through a loss of economic returns and competitive advantage - *leading to a disincentive to invest in innovation.*

# The Circle of Compliance





## CLASP Research

- CLASP surveyed S&L programs in G20 countries (+Tunisia & Chile) and found 30 programs spanning 14 countries
- Comparison with surveys of EU Member States
- To assess the strengths and weaknesses of the compliance infrastructure and capacity
- To provide a greater level of evidence to support efforts to tackle compliance



# Resources

Country	AU	CA	JP	IN	MX	KR	UK
<b>Program</b>	M&L	M&L	TR & VL	ML & VL	M&L	M&L, VL	M&L
<b>USD (000's)</b>	950	500-750	2,180	n/a	184	642	600-1500
<b>Person/yr</b>	n/a	0.2	10	>4	n/a	5.3	n/a

Key: M = MEPS  
VL = Voluntary Labelling

M&L = MEPS and Labelling  
ML = Mandatory Labelling

TR = Top Runner  
n/a = not available

## 50% programs can say how much is spent on compliance per annum

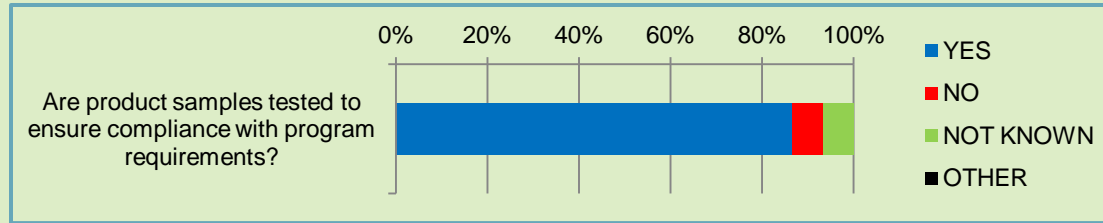
- In these, the amounts vary
- Few have defined budget allocations and forward plans for MV&E activities

## Fewer programs gave staff numbers. MV&E often forms part of staff's functions

- Need to ensure activities are coordinated and recorded; and clear lines of responsibility established

# MV&E Activities

## 80% programs undertake product testing



## 50% could give figures

Country	AU	CN	IN	JP	MX	KR			UK			US
Program	M&L	M&L	L&VL	TR	M&L	M	ML	VL	M	ML	VL	VL
2006	58	54	0	0	91	180	84	160	0	13	75	36
2007	113	73	7	0	132	228	88	135	100	18	0	11
2008	88	124	n/a	24	108	142	93	82	0	300	82	n/a

Key: M = MEPS  
VL = Voluntary Labelling

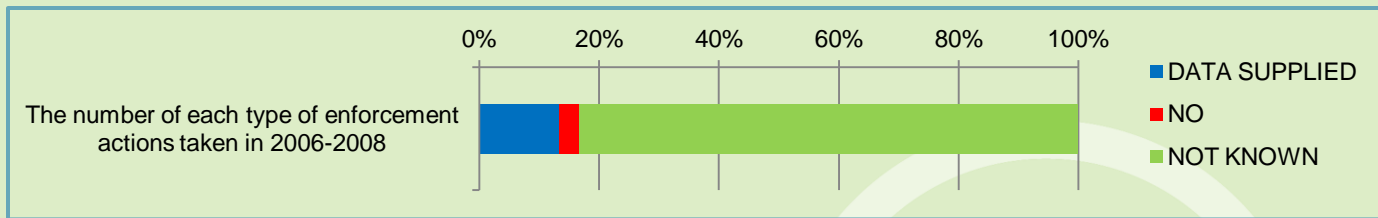
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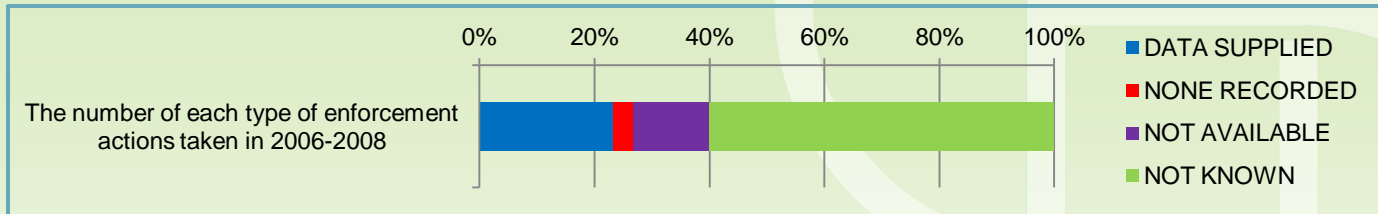
# MV&E Activities

## Very few were able to provide figures for enforcement actions

- Labeling and similar offences found in market surveillance

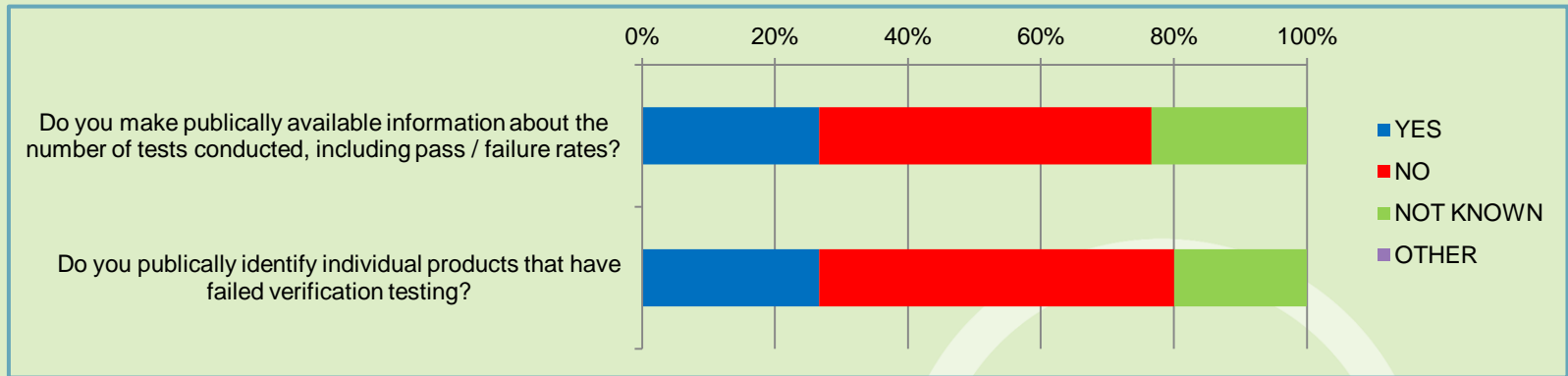


- Performance verification tests



# MV&E Activities

## Public disclosure



## Compliance assessment

